

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device for obtaining the semiconductor device divided into individual pieces of semiconductor elements by cutting a semiconductor wafer, the primary component of which is silicon, on the first face of which the plurality of semiconductor elements are formed, by means of plasma dicing, the method of manufacturing the semiconductor device comprising:

a step of forming an etching stop layer on the first face side at positions corresponding to cutting lines which are set by dividing the semiconductor wafer into the individual pieces, the etching stop layer containing material, the etching rate of the material by plasma, in which a first plasma generating gas of mixed gas containing fluorine gas is used, being lower than an etching rate of etching silicon by plasma in which the first plasma generating gas is used;

a step of attaching a protective sheet, which is capable of being peeled off, onto the first face to form a mask for determining the cutting lines on a second face opposite to the first face;

a first plasma dicing step of etching silicon from the second face side by plasma of the first plasma generating gas; and

a second plasma dicing step of etching the etching stop layer, which is exposed in the first plasma dicing step, by a second plasma generating gas capable of etching at a higher etching rate than the etching rate of the first plasma generating gas.

2. A method of manufacturing a semiconductor device according to claim 1, wherein a ratio of the etching rate of etching silicon by plasma, in which the first plasma generating gas is used, to the etching rate of etching the etching stop layer by plasma, in which the first plasma generating gas is used, is not more than 0.6.

3. A method of manufacturing a semiconductor device according to claim 1, wherein the etching stop layer contains at least SiO_2 , and the second plasma generating gas contains fluorine gas having hydrogen bonding or alternatively contains mixed gas containing fluorine gas.

4. A method of manufacturing a semiconductor device according to claim 3, wherein the second plasma generating gas contains mixed gas containing CHF_3 or $\text{CF}_4 + \text{H}_2$.

5. A method of manufacturing a semiconductor device according to claim 1, wherein the etching stop layer

contains at least SiN, and the second plasma generating gas is mixed gas containing at least fluorine gas and oxygen.

6. A method of manufacturing a semiconductor device
5 according to claim 5, wherein the second plasma generating gas contains mixed gas containing SF₆ and O₂.

7. A method of manufacturing a semiconductor device
according to claim 1, wherein the etching layer contains at
10 least organic matter, and the second plasma generating gas contains at least oxygen.

8. A method of manufacturing a semiconductor device
according to claim 1, wherein the etching stop layer
15 contains at least an electric conductor used for the wiring of semiconductor elements.

9. A method of manufacturing a semiconductor device
according to claim 8, wherein the electric conductor
20 contains at least one of Al, Al-Si and Al-Si-Cu, and the second plasma generating gas contains at least chlorine or chlorine compound gas.

10. A cutting device of cutting a semiconductor wafer used for the method of manufacturing a semiconductor device, comprising:

5 a processing chamber of forming a tightly closed space;

an electrode having a plane tightly coming into contact with the protective sheet;

10 a holding means for holding the semiconductor wafer by the electrode under the condition that the protective sheet is tightly contacted with the plane;

a pumping means for decompressing the processing chamber;

a plasma generating gas supply section of supplying plasma generating gas into the processing chamber; and

15 a high frequency electric power supply section of impressing a high frequency voltage upon the electrode so as to transfer plasma processing gas, which is supplied into the processing chamber, into a state of plasma,

20 wherein the plasma generating gas supply section includes a gas selecting means for selectively supplying the first plasma generating gas used in the first plasma dicing step or the second plasma generating gas for generating plasma capable of etching the etching stop layer, which is exposed by the first plasma dicing step, at

a higher etching rate than the etching rate of plasma of the first plasma generating gas.